Projections for Hawai`i

June 18, 2012

NOAA Pacific Islands Corals Science Workshop

Projections for Hawai`i

INTERNATIONAL PACIFIC RESEARCH CENTER

Thanks to Axel Lauer, Chunxi Zhang, Yuqing Wang

Climate Change in the Status Review Report

- **IPCC AR4 (2007)**
- **Review of recent developments**
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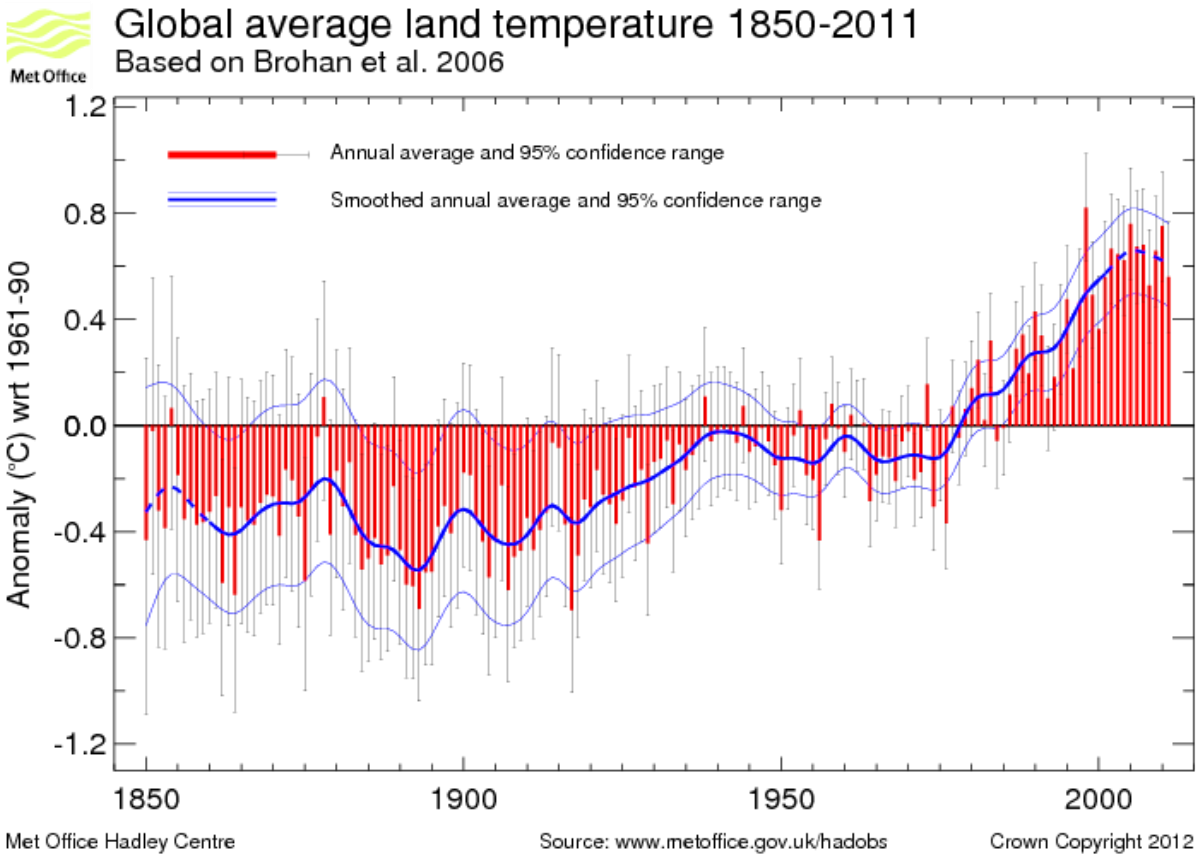
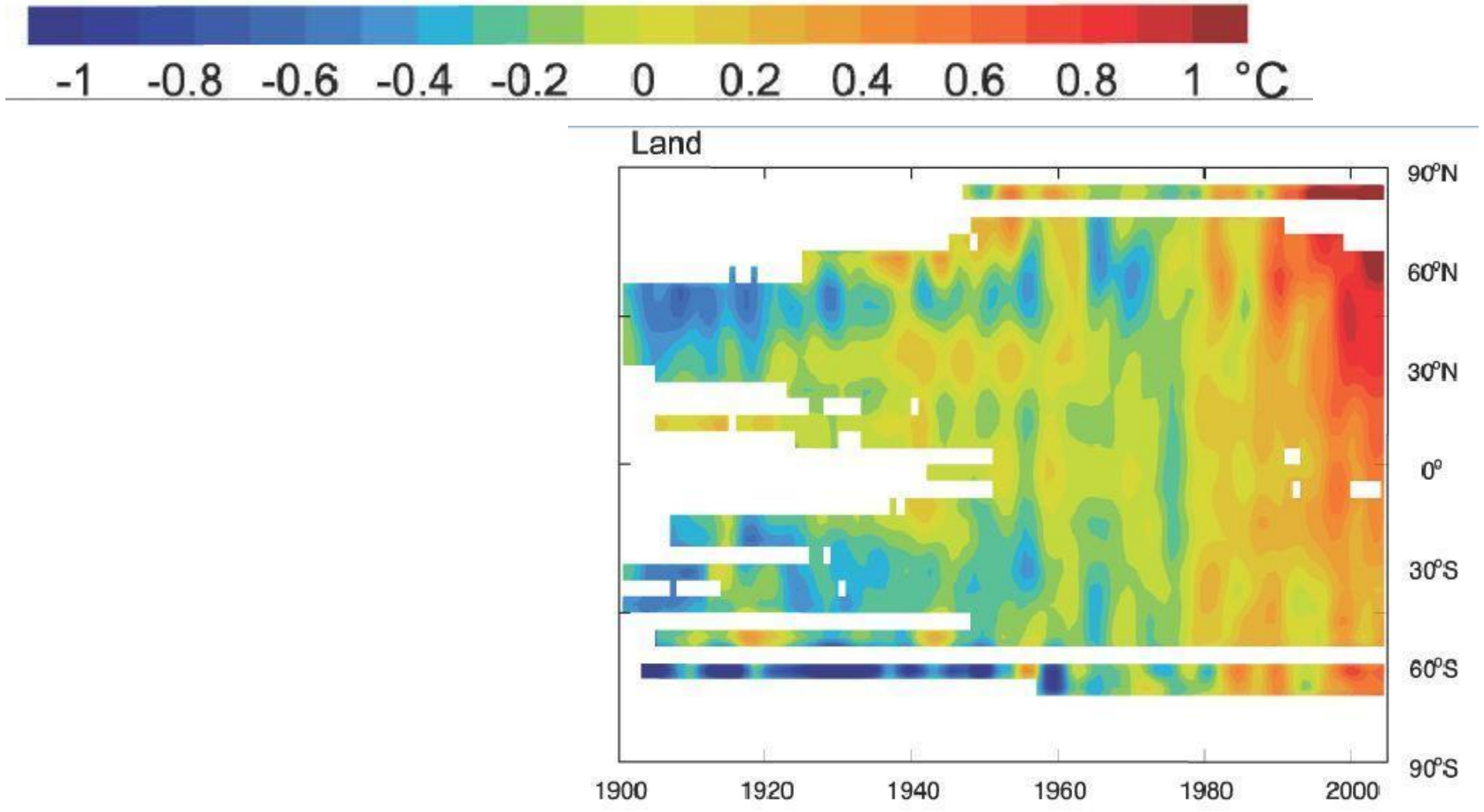
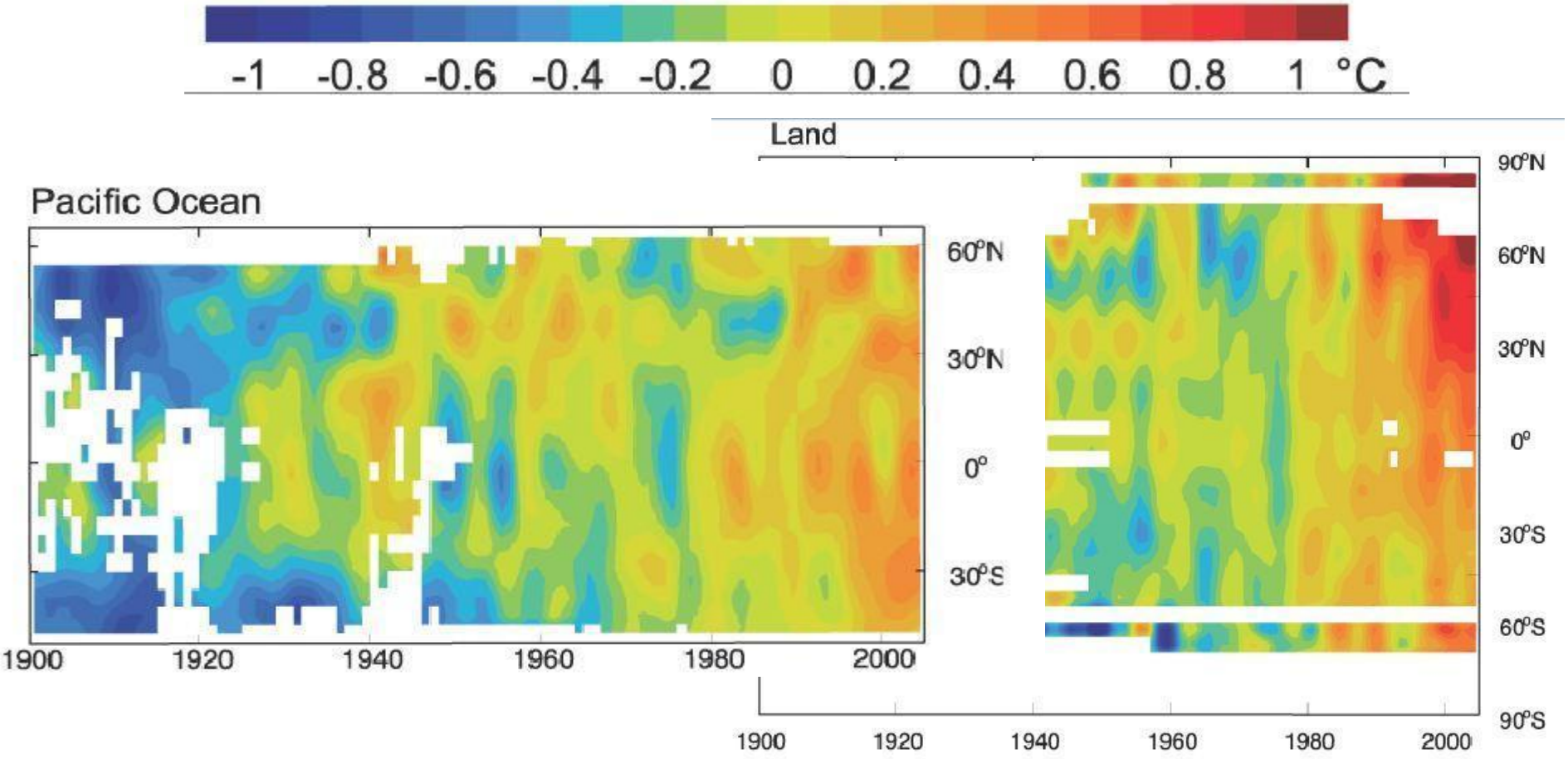
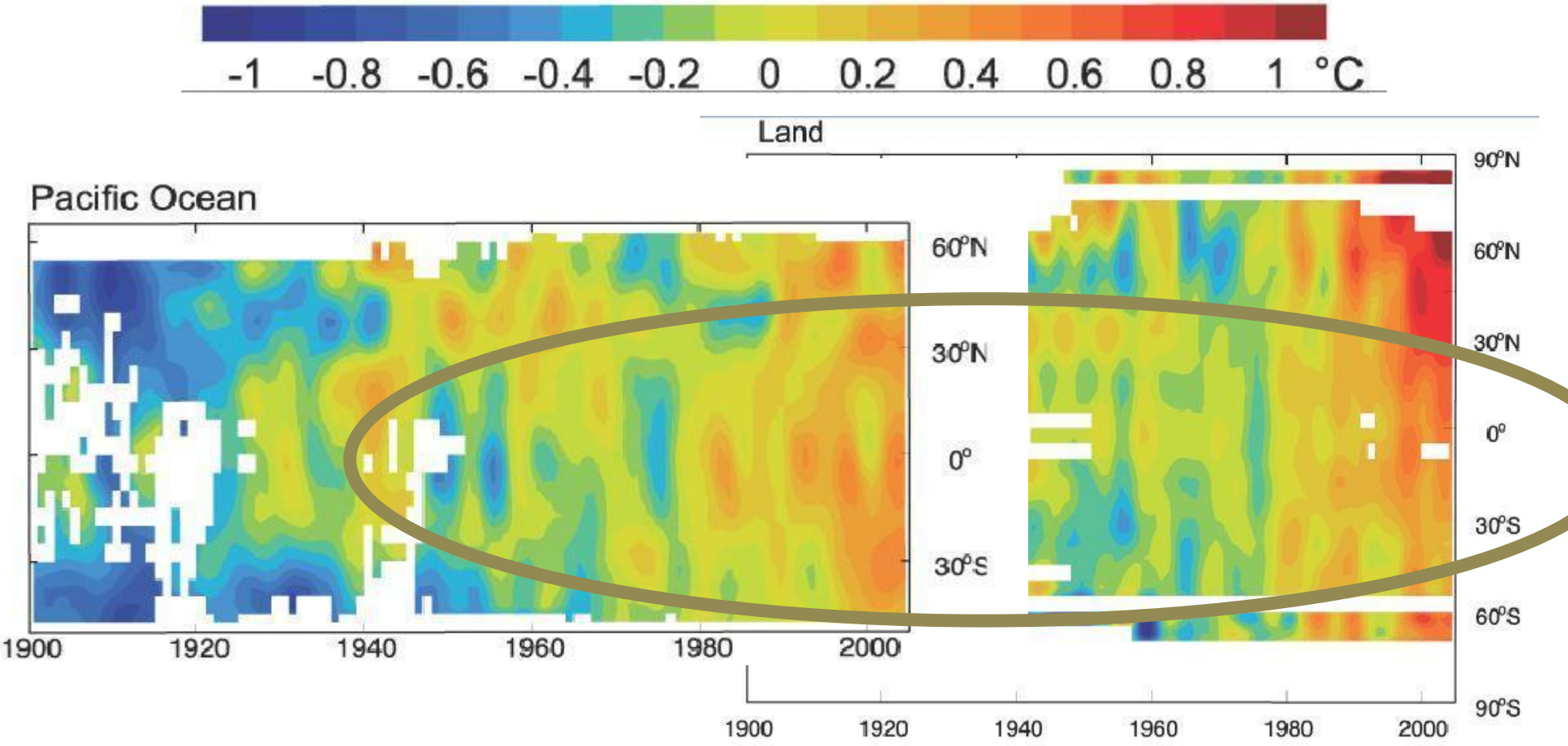
Climate Change in the Status Review Report

- **IPCC AR4 (2007)**
- **Review of recent developments**
- **Comments on natural variability & predictability**
- **Unpublished work on CMIP5 analysis & regional modeling**


Met Office
Global average land temperature 1850-2011
Based on Brohan et al. 2006
Annual average and 95% confidence range
Smoothed annual average and 95% confidence range
Anomaly (°C) wrt 1961-90
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
1850
1900
1950
2000
Met Office Hadley Centre
Source: www.metoffice.gov.uk/hadobs
Crown Copyright 2012


-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1 °C
Land
90°N
60°N
30°N
0°
30°S
60°S
90°S
1900
1920
1940
1960
1980
2000


-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1 °C
Pacific Ocean
Land
60°N
30°N
0°
30°S
1900
1920
1940
1960
1980
2000
90°N
60°N
30°N
0°
30°S
60°S
90°S

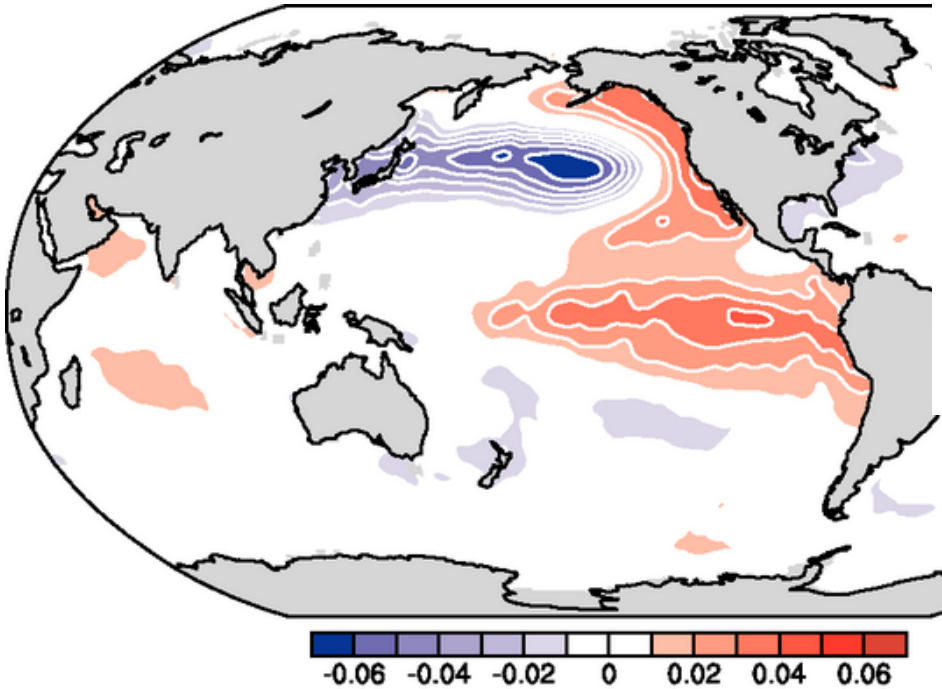


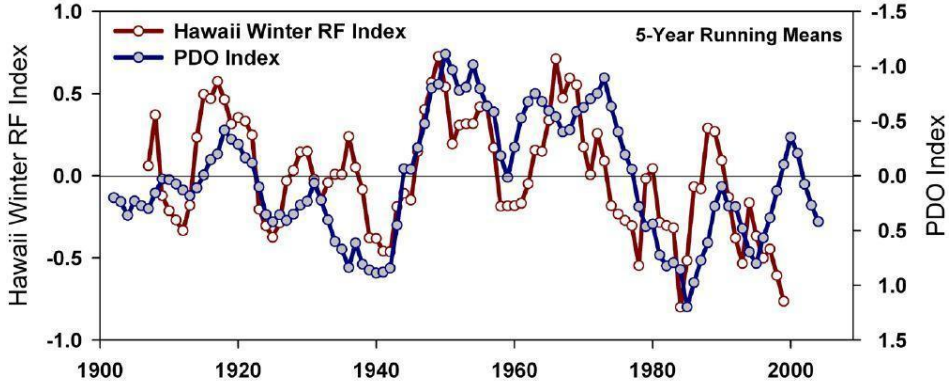
***Less warming over ocean than land**

***Tropical/subtropical Pacific has strong interdecadal variability**

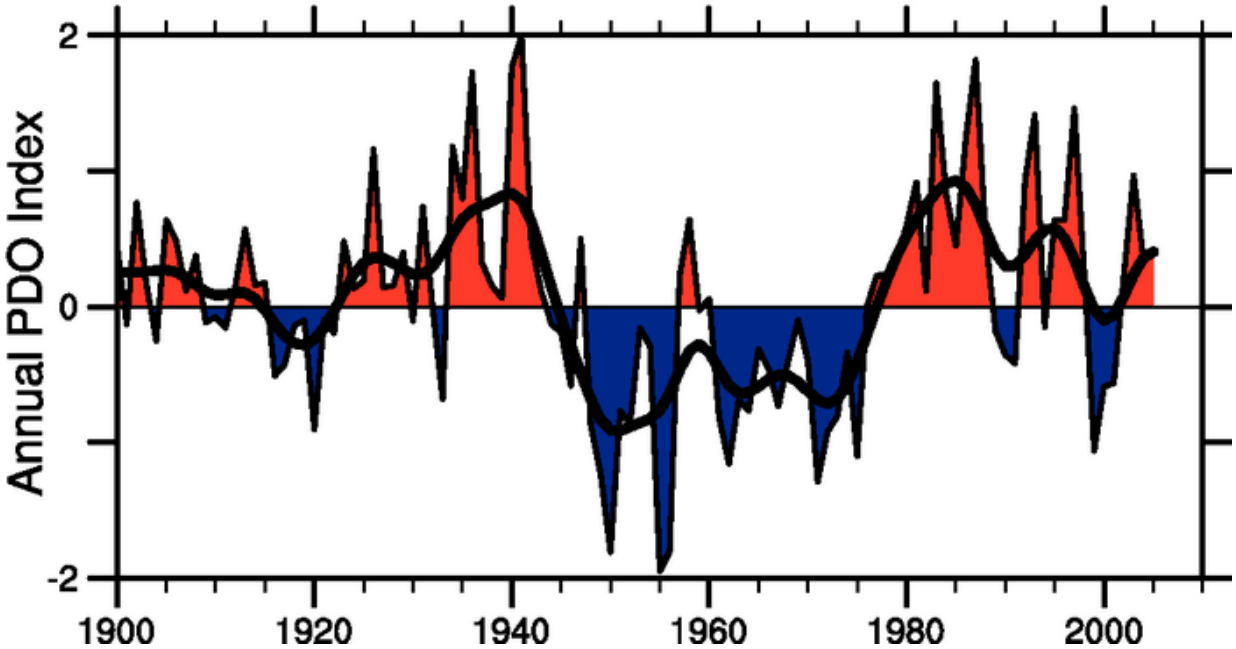
reducing the predictability of temperature changes - the natural

variability is not predictable beyond ~5 years

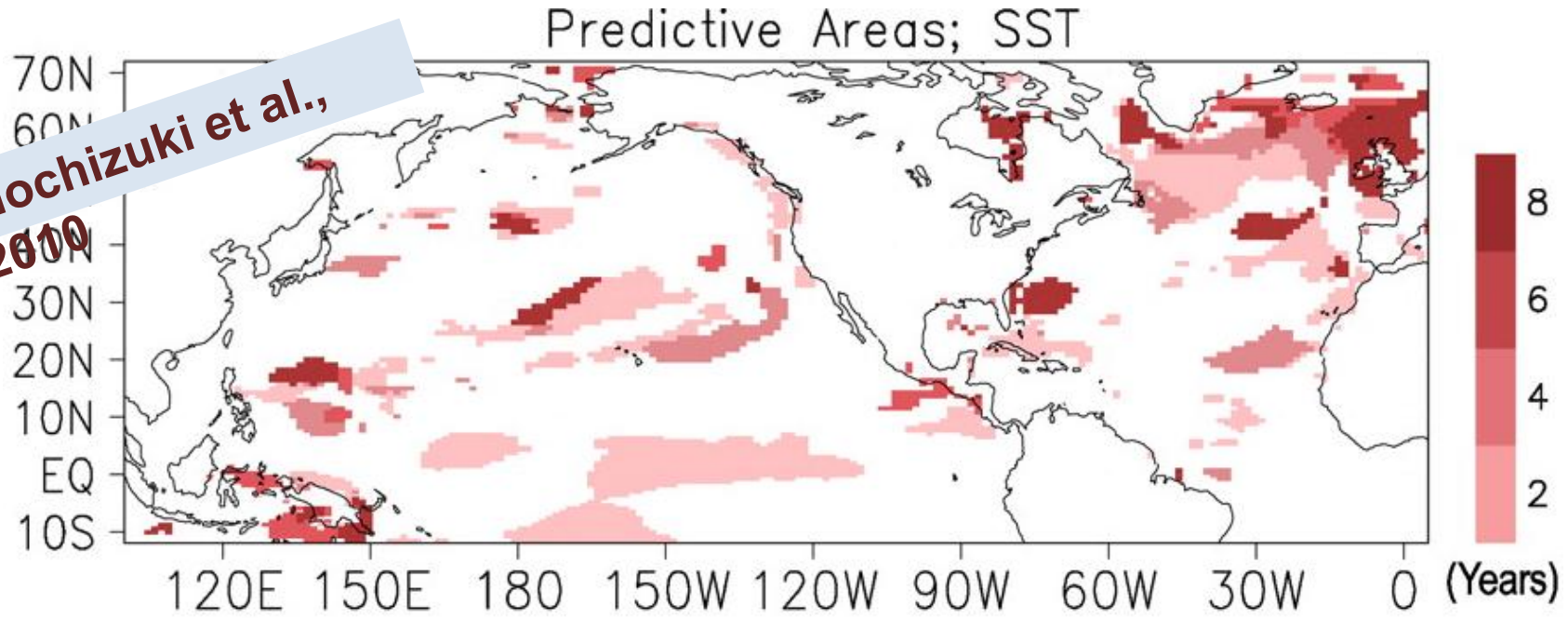


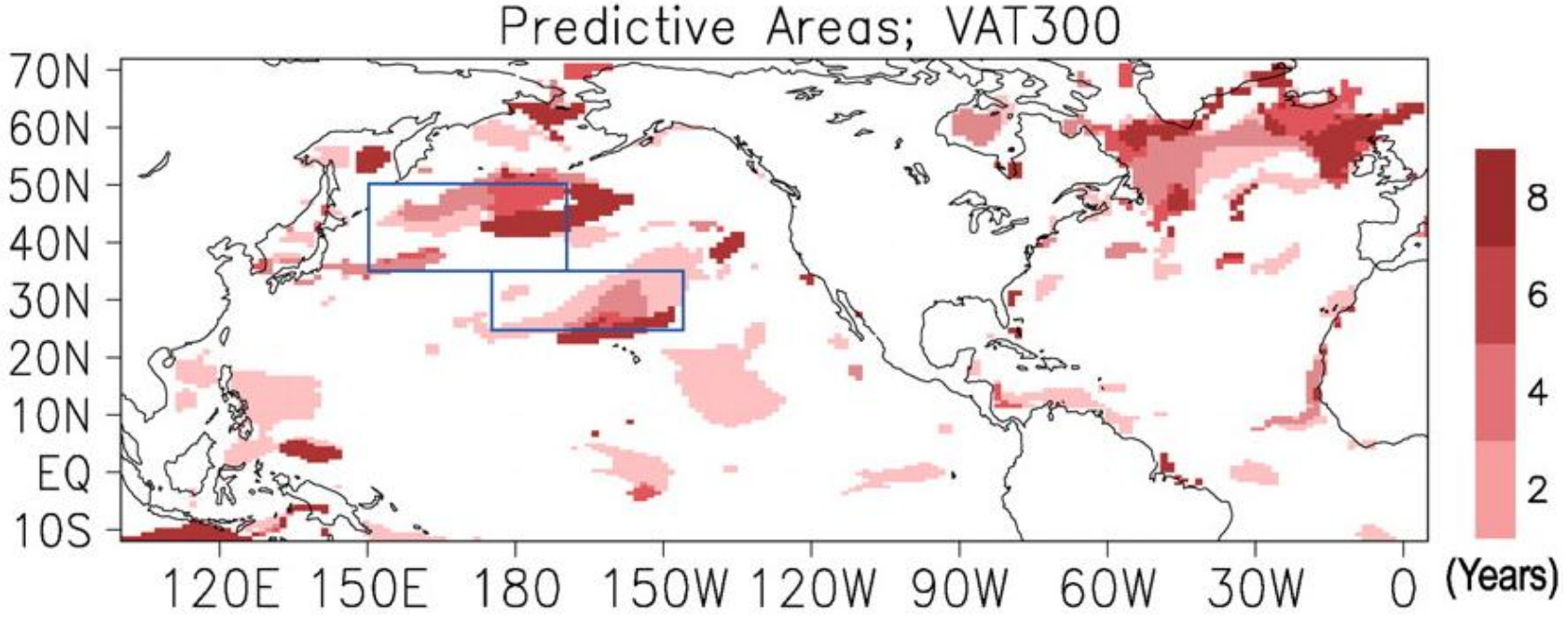


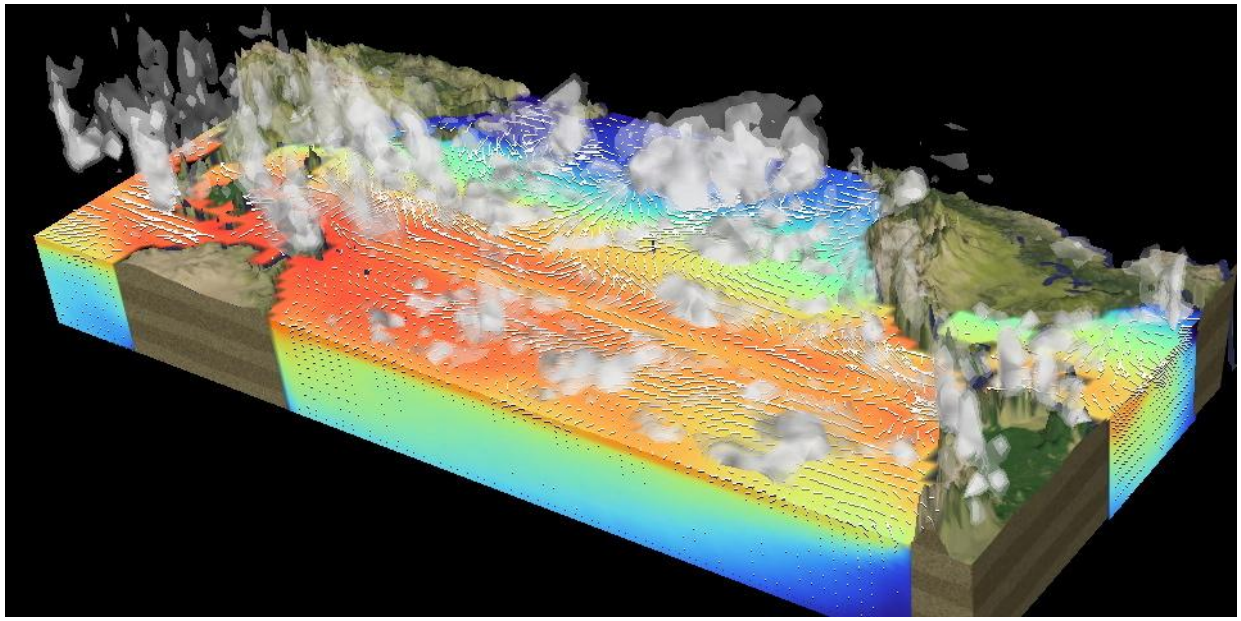
T. Giambelluca



Mochizuki et al., 2010



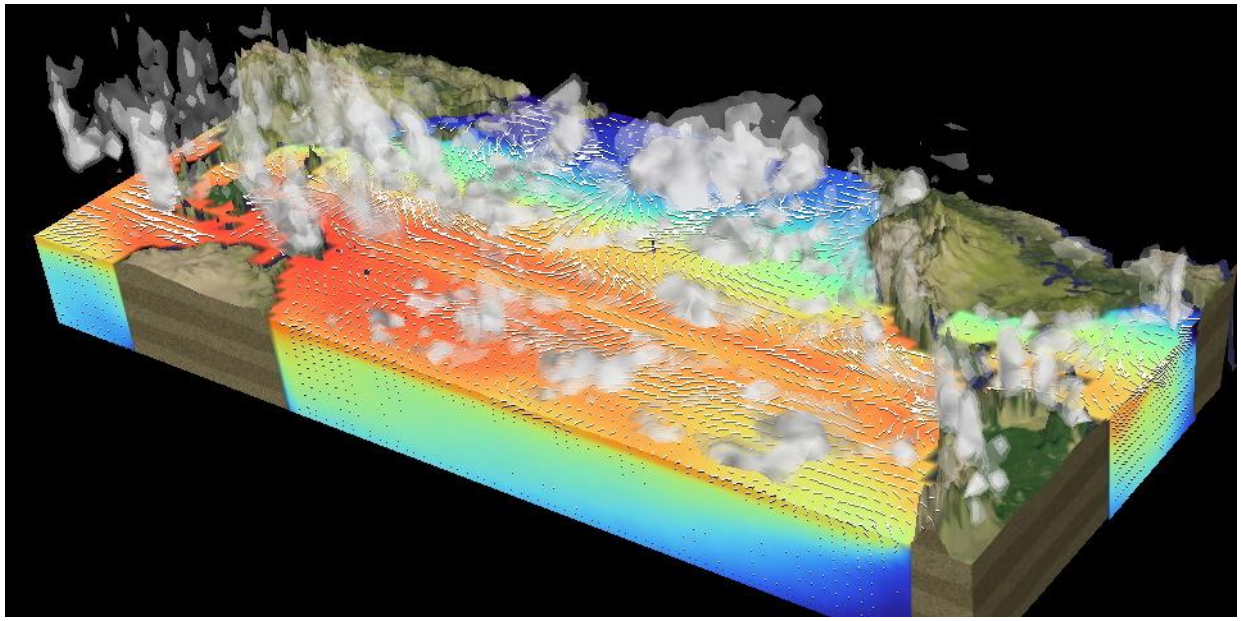




Coupled Global Climate Models

CMIP3 (2005) → IPCC AR4 (2007)

CMIP5 (2011) → IPCC AR5 (2013)



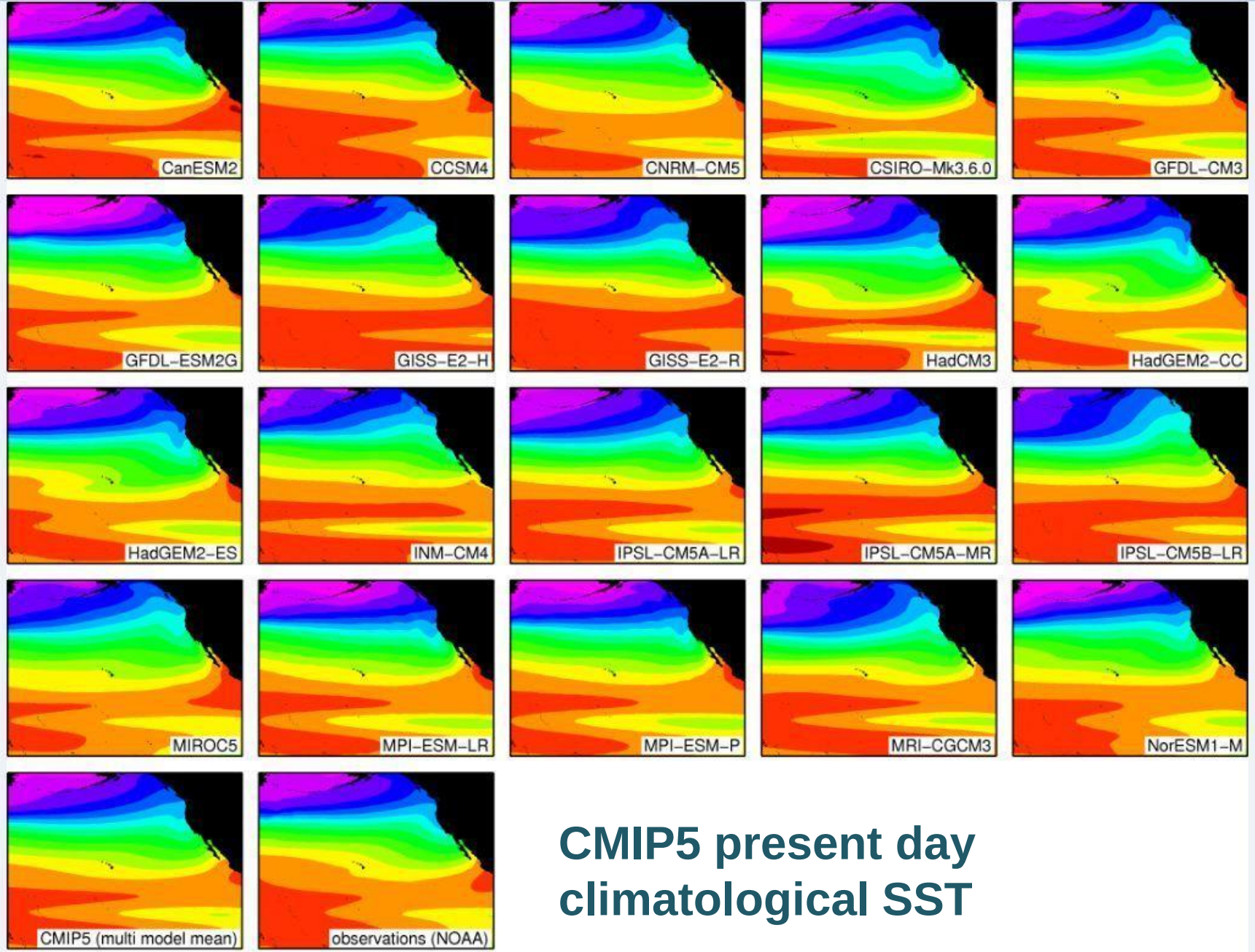
Coupled Global Climate Models

CMIP3 (2005) → IPCC AR4 (2007)

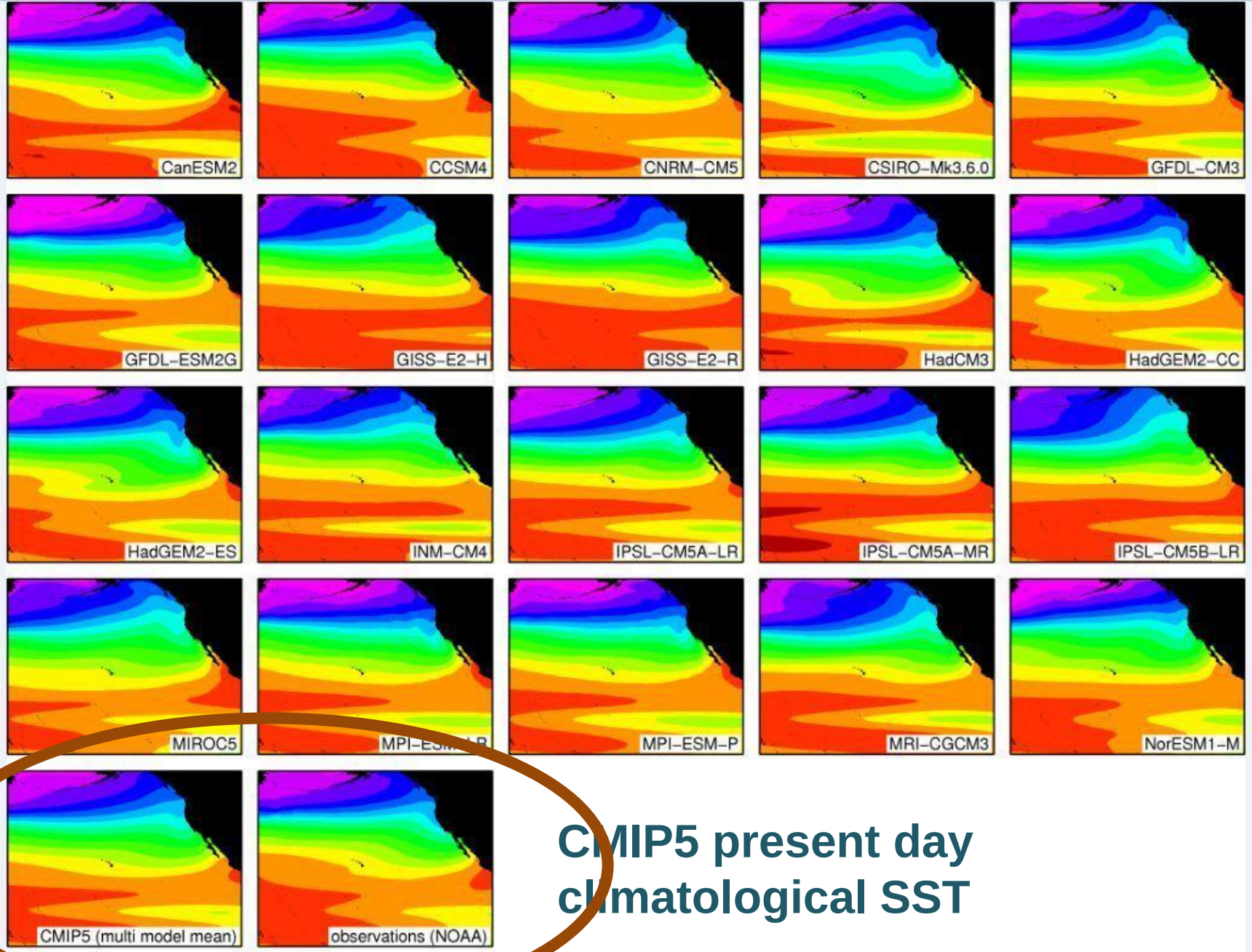
CMIP5 (2011) → IPCC AR5 (2013)

CMIP5 Model Projections of SST Warming 2090-2099 vs 1990-1999

RCP4.5 scenario



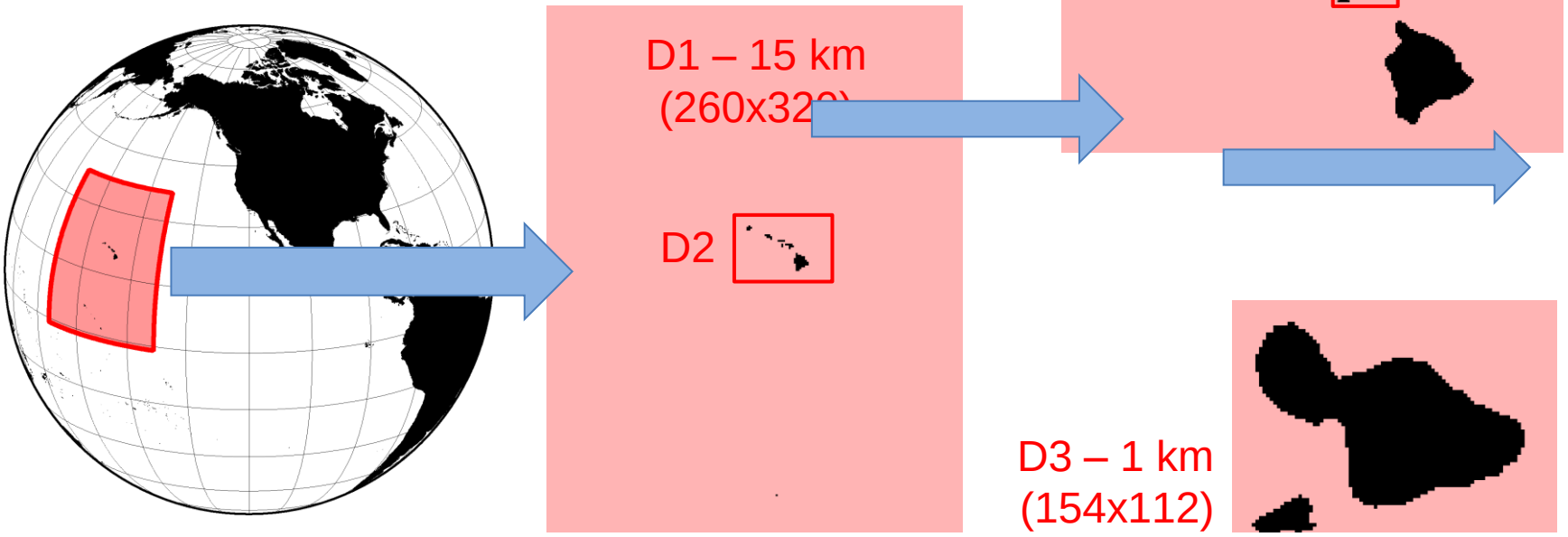
CMIP5 present day climatological SST



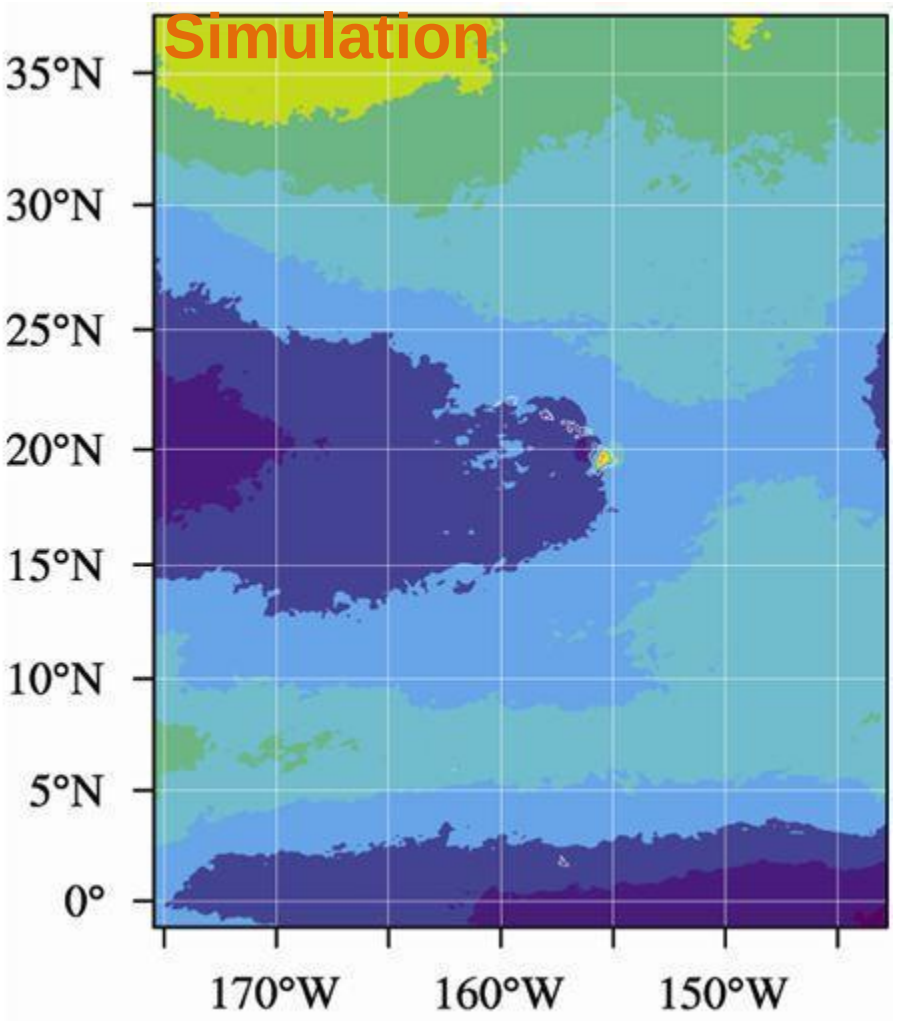
CMIP5 present day climatological SST

The Hawaii Regional Climate Model (HRCM)

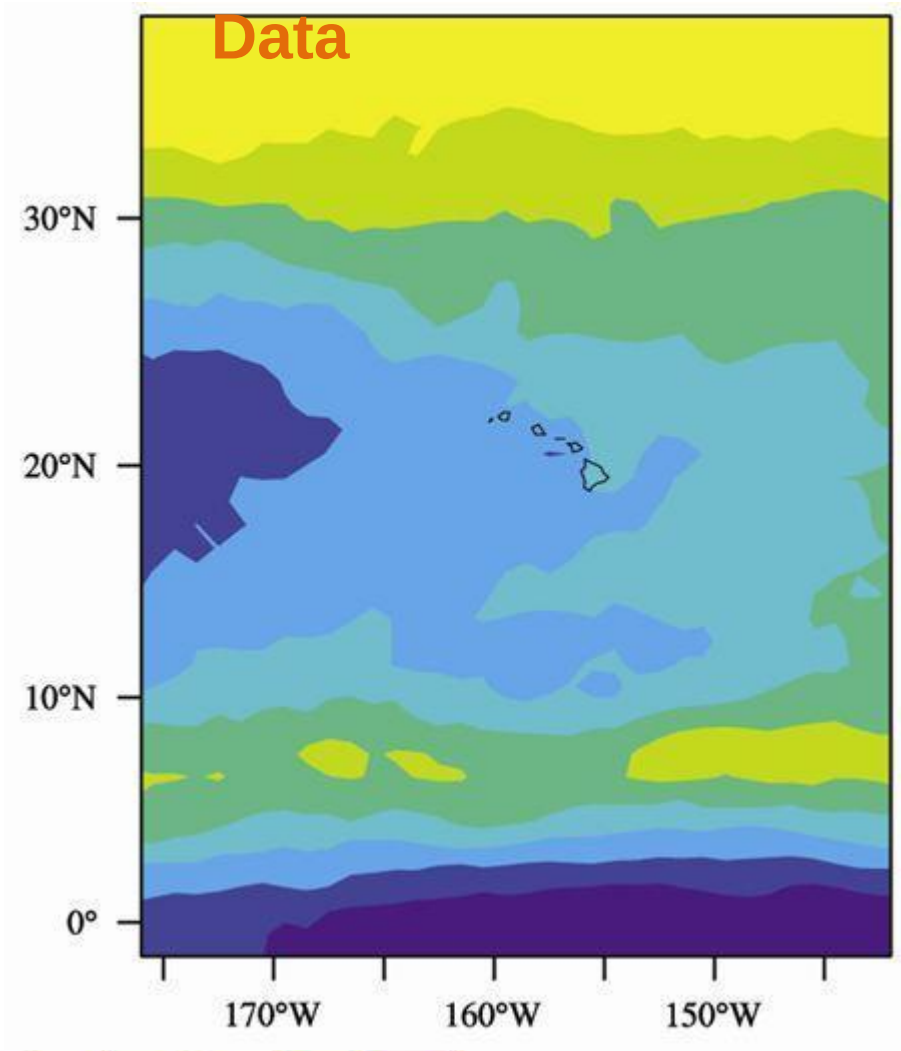
- 31 vertical levels (14 levels below 700 hPa)
- New data sets for: land cover/use (NLCD), surface albedo (MODIS), vegetation types/fraction and soil types (STATSGO2)
- MERRA (Modern-Era Retrospective Analysis for Research and Applications) reanalysis from NASA (6-hourly data @ 0.5°×0.67°)
- NOAA SSTs (daily data @ 0.25°x0.25°)
- 1-way nesting with up to 3 domains (D1, D2, D3)

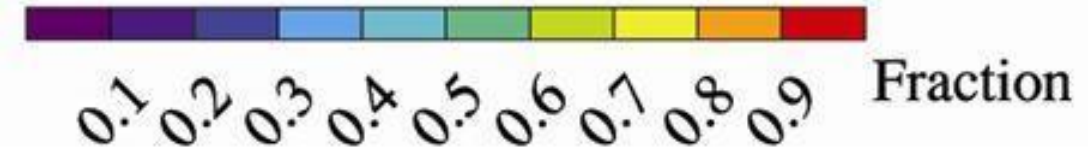


Regional Model Simulation



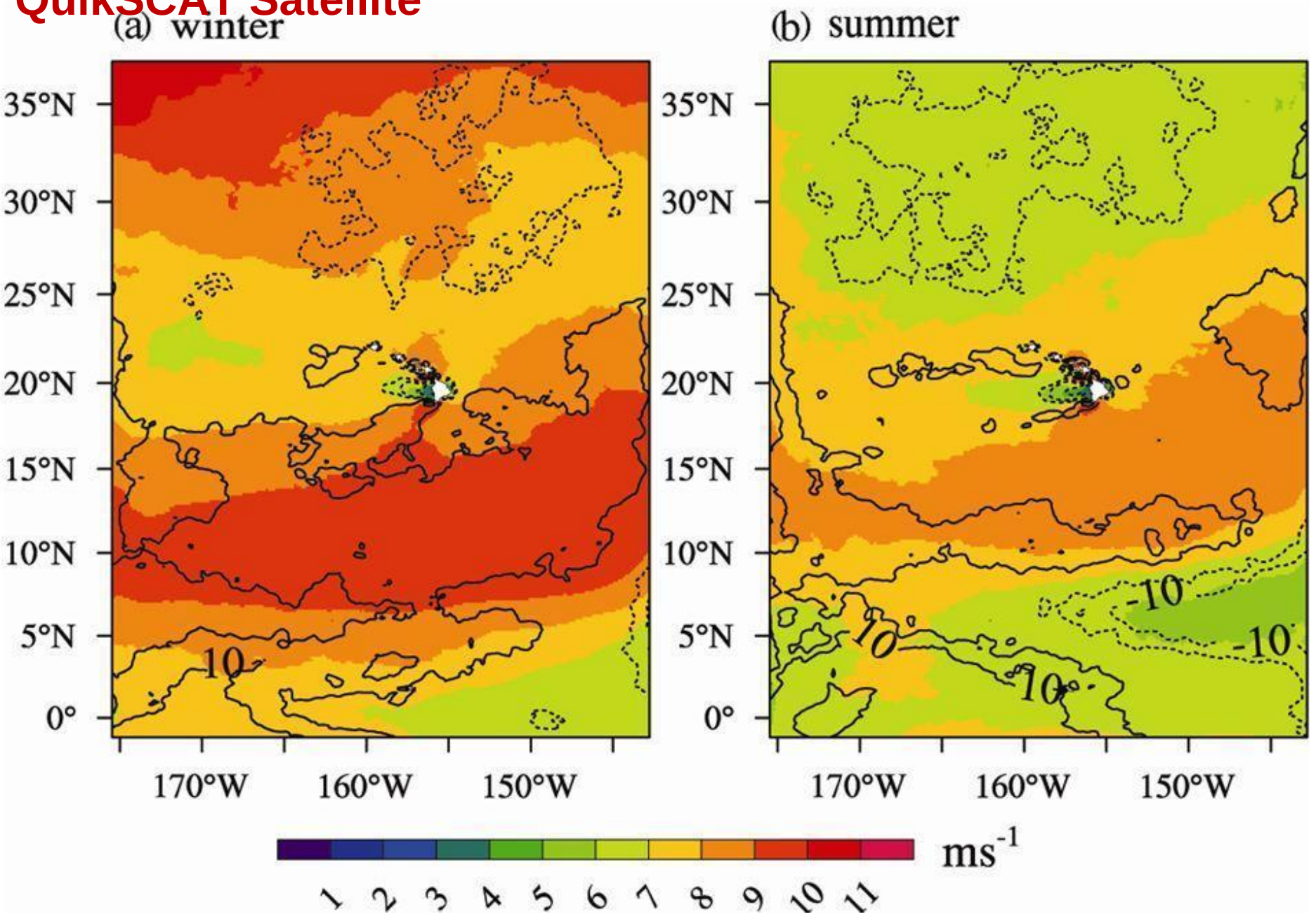
MODIS Satellite Data





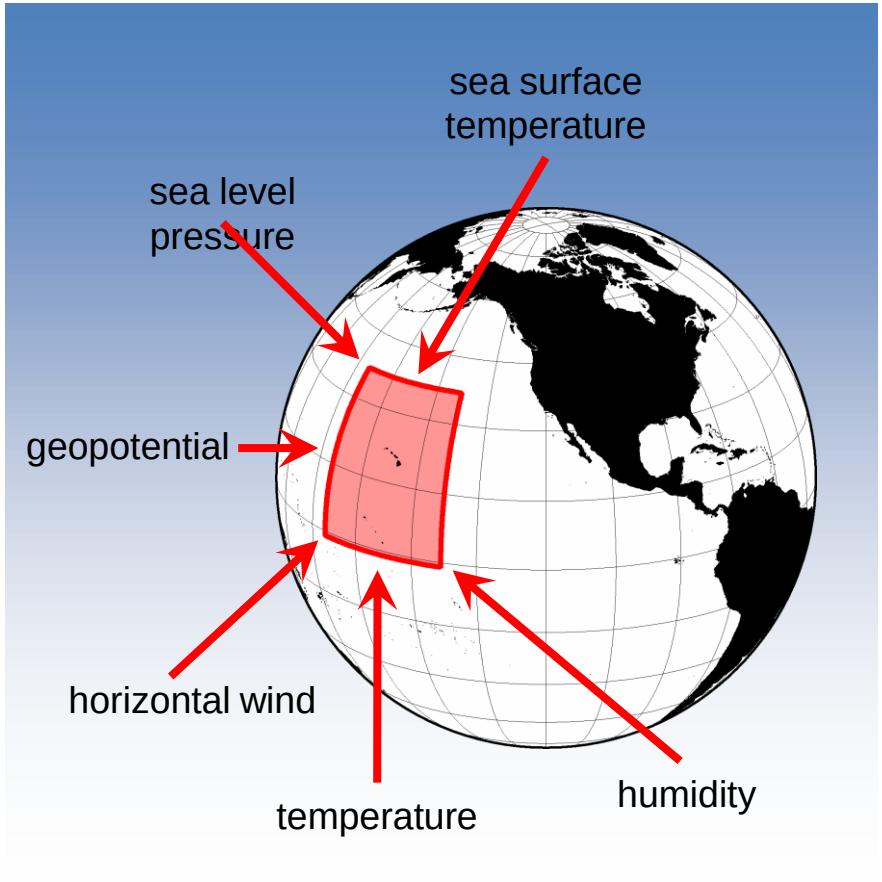
Winter Mean Total Cloud Cover

Mean Surface Wind Speed Over Ocean – Model vs QuikSCAT Satellite



Specification of the boundary conditions

Pseudo-Global-Warming Method (*Kimura and Kitoh* 2007; *Sato et al.* 2007)



MERRA reanalysis data, NOAA SSTs

Present-day Run

MERRA reanalysis data, NOAA SSTs

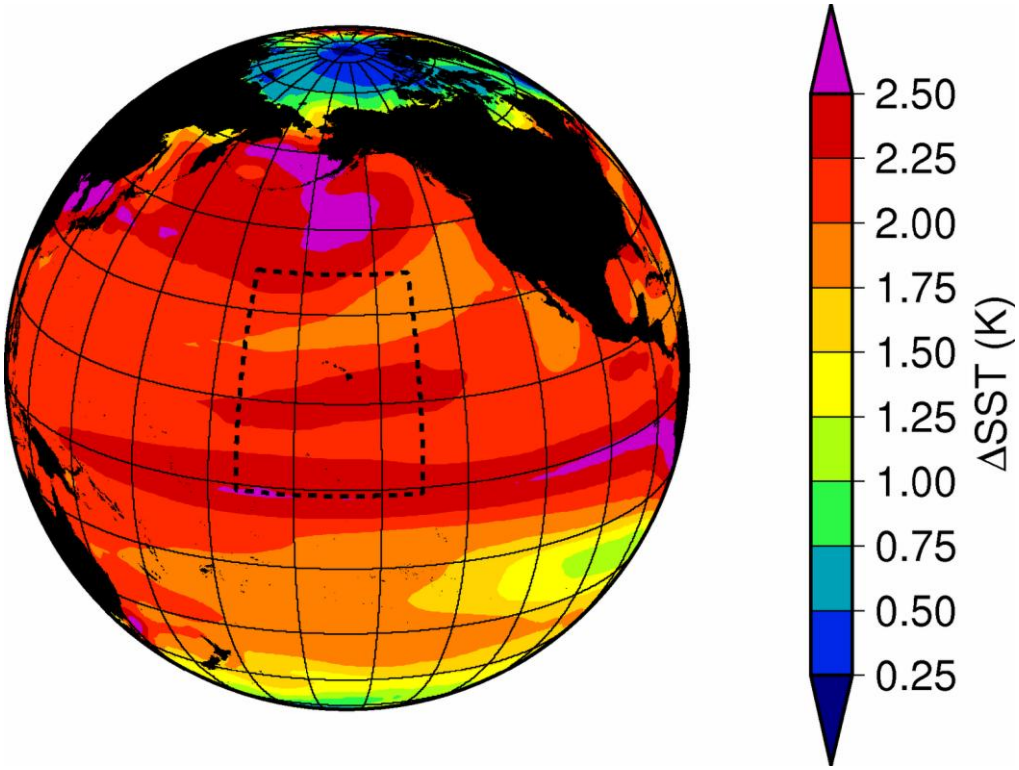
+

Global warming increment (monthly means)

Global Warming Run

Global warming increment: SST

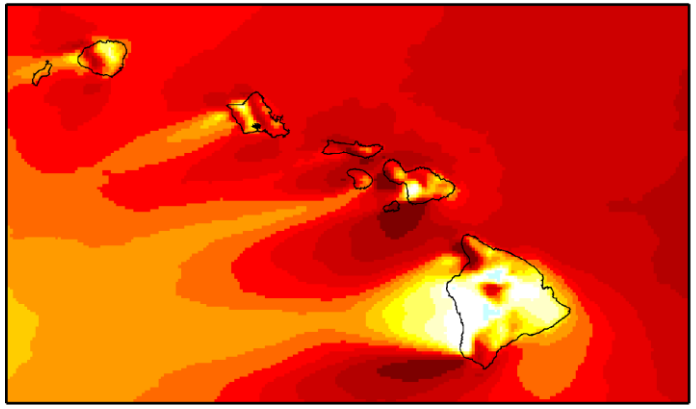
Future scenario (SRES A1B, 2090-2099) – present-day (20C3M, 1990-1999)



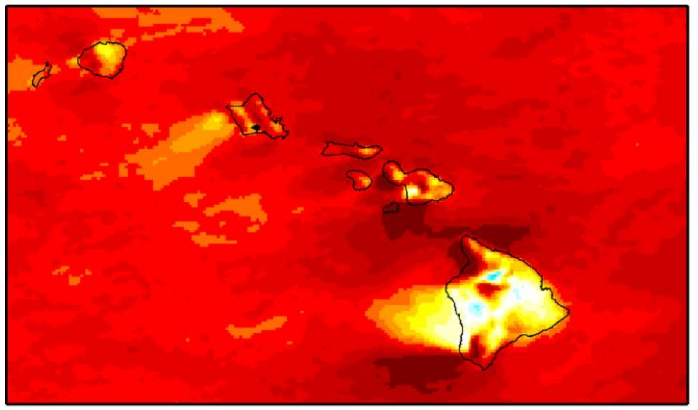
Multi-model mean (16 CMIP3 models)

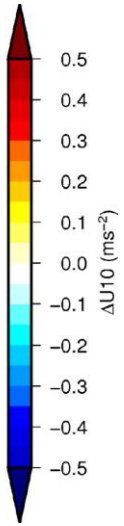
Annual average changes in 10-m wind speed (ms^{-1})

∆ mean U10



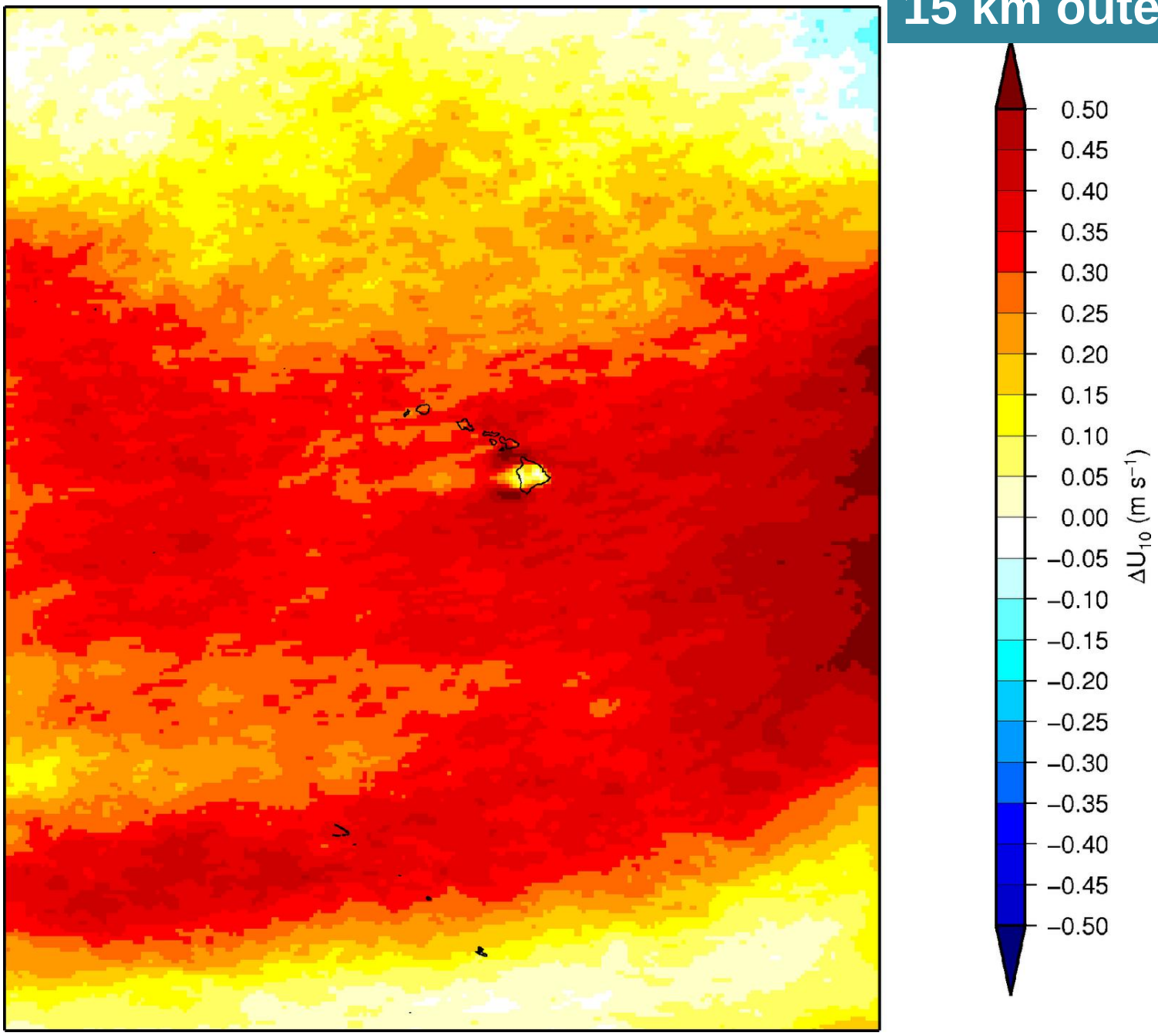
∆ daily maximum U10





A windier/stormier central North Pacific?

15 km outer


0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20
−0.25
−0.30
−0.35
−0.40
−0.45
−0.50
ΔU10 (m s−1)

Things we will do/could do..

- **Regional model runs with forcing based on CMIP5 global model results**
- **Regional model runs focussed on other islands in the Pacific**
- **Further analysis of both global and regional results (e.g. look at interannual variability, higher frequency variability such as storm statistics)**
- **Add ocean wave model?**


Thank you!